



# INTERACTIVE SOFTWARE: MeshTools

## ISE-MeshTools Tutorials

### Tutorial 06 : working with tags part 2

#### tagging objects containing unconnected regions

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Tutorial 06 includes:

- One .vtk surface file representing a right inner ear of *Mus musculus*
- One .pos file
- One .ntw file
- One .tag file
- One .ori file
- The present .pdf document

# **Working with tags part 2: tagging objects containing unconnected regions**

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## 1. “Unconnected regions”

By “objects containing unconnected regions” I refer here to surface files containing sub-regions separated in space.

## 2. About the specimen

The surface file enclosed in this tutorial represents the three-dimensional reconstruction of the cranium of the foetus of a house mouse (*Mus musculus*) from the collections of the ENS-Lyon. The 3D data were obtained by computerized microtomography at the MRI  $\mu$ CT platform housed at the ISE-M. The specimen (E17) was published in Hautier et al. (2014).

## 3. Tutorial


Before using this tutorial, I strongly recommend to download and read ISE-MeshTools User Manual, especially the “Tag” section, and the tutorial “working with tags part 1”.



### 3.1 Download and unzip files

Download and unzip the files associated to this tutorial in a folder containing no accent. Open ISE-MeshTools. Also, make sure that the path leading to the folder containing the tutorial files does not contain any accent. Otherwise, ISE-MeshTools will not be able to open the contained files.

### 3.2 A brief overview of enclosed files


#### 3.2.1 Prerequisite : activate Tag mode, and display tags.


Press “” to activate the “draw tag mode”. The tag mode is useful when tagging surfaces (as you can only interact with selected objects).


Pressing “” automatically activates the “display tag mode” (which can be activated/deactivated independently from the “draw tag mode” by pressing “”). When active, a colour scale bar shows up inside the 3D screen.


Now, unselected meshes are drawn “grey”, while selected meshes can be drawn according to tag values at each vertex.


#### 3.2.2 Mouse foetus cranium surface and position files


You may load the enclosed .vtk file (File -> Open Surface, then select “Mouse\_foetus.vtk”). When loaded this way, the corresponding opened surface object is selected, which means that it is drawn according to the tag values when the “display tag mode” (“”) is active. As mentioned in other tutorials, you may interact with selected objects in different ways (see ISE-MeshTools manual for further explanations). As a general rule, when opening a new object, I strongly recommend to change its position in order that it matches the 6 predefined camera positions :


When pressing “”, object should be viewed from right side.

When pressing "", object should be viewed from left side.

When pressing "", object should be viewed from front side.

When pressing "", object should be viewed from back side.

When pressing "", object should be viewed from above.


When pressing "", object should be viewed from below.

Once correctly positioned, you may save the object's current position (File->Position->Save Position).

The present tutorial contains a .pos file, which you may load in order to place correctly the cranium (File -> Open Position, then chose "Mouse\_foetus.pos").

You can unselect all opened objects by pressing "CTRL +D", or select all objects by pressing "CTRL +A". You can delete all selected objects by pressing "Del".

### 3.2.3 Mouse cranium project file

The present tutorial contains a project .ntw file, which may be useful to directly open the cranium of the foetus in a convenient position directly. First, delete all currently opened objects (press "CTRL+A", then press "Del"). Then open the enclosed .ntw file (File->Open Project, then select "Mouse\_foetus.ntw"). Once loaded, the cranium of the mouse is opened, is given the position enclosed in the "Mouse\_foetus.pos" file. Note that the newly opened surface is unselected, the consequence of which is that when the display tag mode ("") is active, the surface is drawn grey. If you want to display tags, right click on the cranium to select it.

### 3.2.4 Mouse cranium .ori file


The present tutorial contains a .ori file, which contains orientation labels for the coordinate system orientation helper. You can load this file the enclosed .ori file (File->Orientation labels, then select "Mouse\_foetus.ori"). Once loaded, the system coordinate orientation helper will show the following labels :

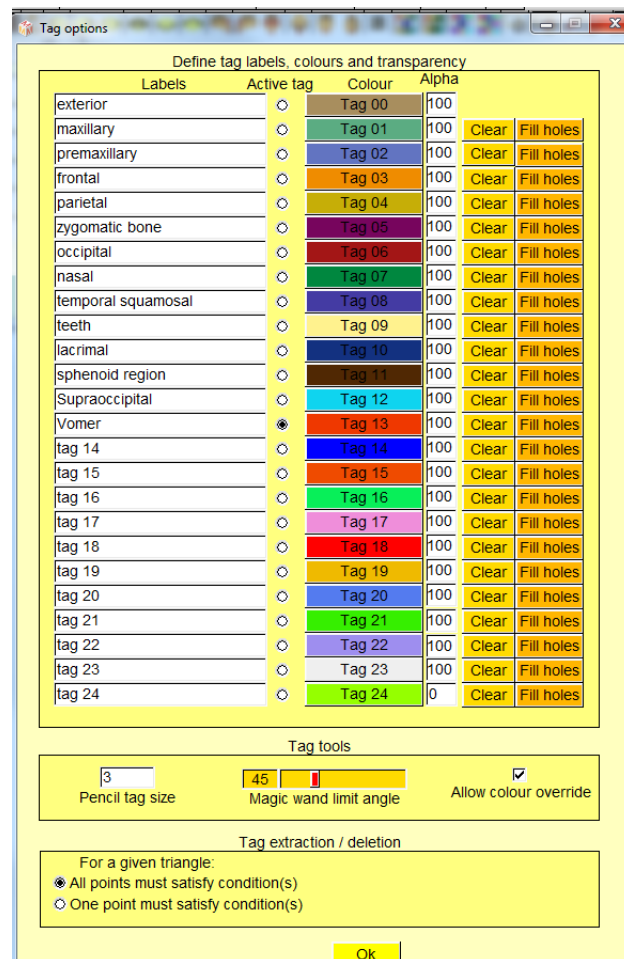
+z axis : dorsal  
-z axis : ventral  
+y axis : left  
-y axis : right  
+x axis : proximal  
-x axis : distal

You may set your own orientation axis labels with the "Edit orientation labels" window (Viewing opt.-> Orientation labels)

### 3.2.5 Mouse cranium.tag file

The present tutorial contains a .tag file, which contains colours, labels, and transparencies for the 25 editable available tags in ISE-MeshTools. Once loaded (File->Tags and Flags -> Load tag colours and labels, then select "Mouse\_foetus.TAG"), you may notice that the colours of the cranium have changed.

Also, the information contained in the "Tag options" window have been updated (open this window by pressing "  ").



Tags window after loading the .TAG file

#### Available controls :

##### Define tag labels, colours and transparency group:

**Labels** : you may define tag labels for all 25 available tags.

**Active tag** : you may define the currently active tag.

**Colour** : you may define the colour for all 25 available tags.

**Alpha** : you may define the transparency for all 25 available tags.

**Clear** : clears the tag region (all vertices of this region will be set to 0 = Tag 00).

**Fill holes** : opens the fill hole window.


You may define your own tag labels, colours and transparencies in this window.

### 3.3 Tagging objects containing unconnected regions with ISE-MeshTools

#### 3.3.1 Recommendations

While tagging, I recommend you to let the “Tag options” window open. You will often need to change the active tag

#### 3.3.2 Digitization strategy

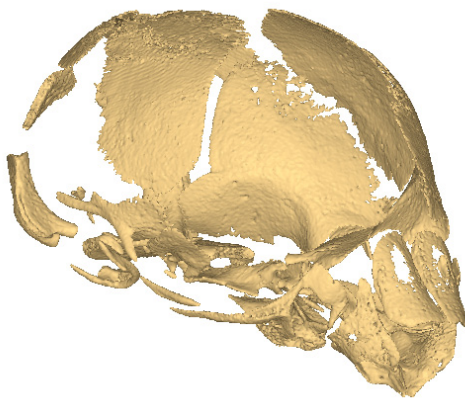
To tag this cranium, you may only use the flood fill tag tool. Press  to activate the flood fill.

##### 1) Clear the current tags

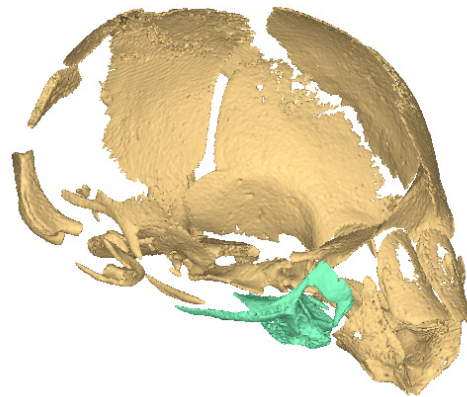
In the “Tag options” window, press “clear” from Tag 01 until Tag 13.

##### 2) Tag the bones one by one

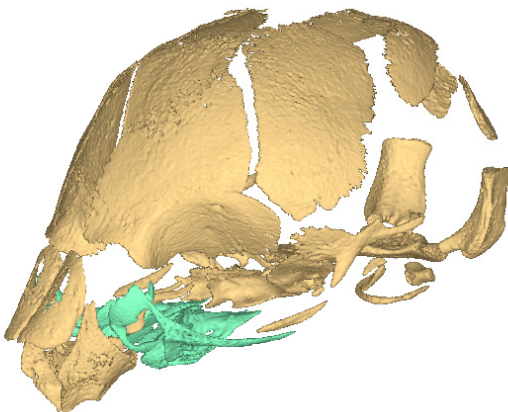
Select for instance Tag 01 (maxillary). Press “T” + left click on the maxillary right region. Repeat the operation for all the bones.



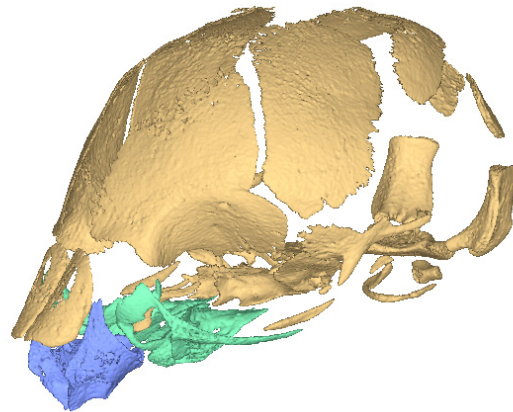
Cleared cranium



Right maxillary tagged using the flood fill tool.



Left maxillary tagged using the flood fill



Premaxillary tagged using the flood fill

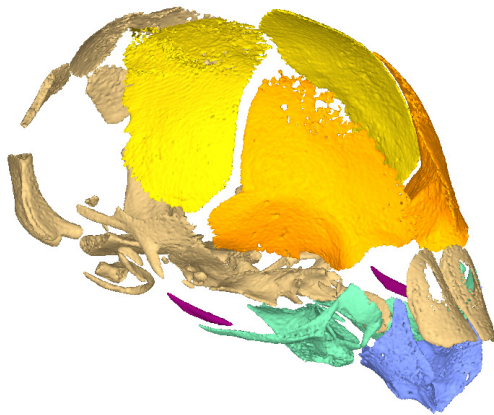




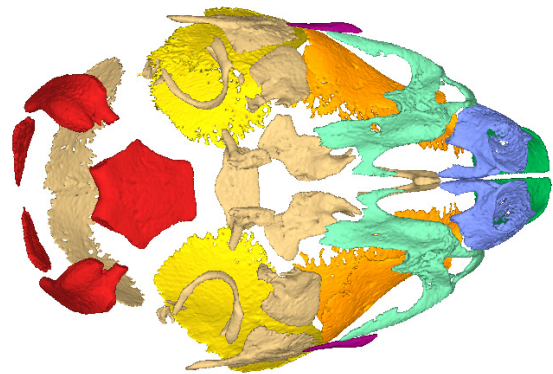
**Left and right frontal bones tagged**



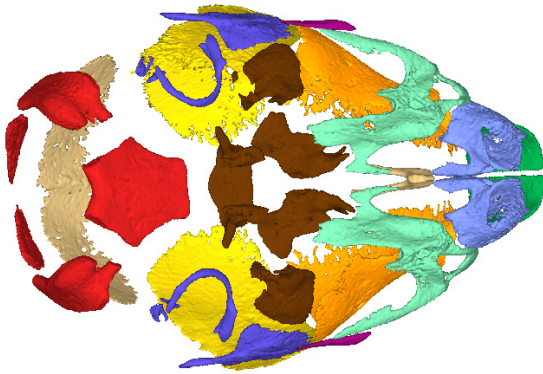
**Left and right parietal bones tagged**



**Left and right zygomatic bones tagged**



**Occipital and nasal bones tagged**



**Temporal, squamosal and sphenoid regions tagged**



**Supra-occipital bone tagged.**

### 3.4 Saving tags

Remember to regularly save your .vtk file, as there is no “CTRL +Z” option in MeshTools yet.

## 4. Acknowledgements

I wish to thank Lionel Hautier and Cyril Charles, for giving public access to the specimen E17. Thanks

## 5. References

**Hautier L, Charles C, Asher RJ, Gaunt SJ.** 2014. Ossification sequence and genetic patterning in the mouse axial skeleton. *Journal of Experimental Zoology Part B: Molecular and Developmental Evolution*.